Speed Letter®

QTXCF 8.4.2.1
2/15/1986

To Shannon & Wilson, Inc.
P.O. Box C 30313
Seattle WA 98103-8067

From H.L. Bacon

Subject ATTN: H.H. Druebert

—No 9 & 10 FOLD

MESSAGE

Enclosed are field notes regarding Slide @ M.P. 7 near Queidall, WA. Pages 4 and 8 thru 13 are applicable. Any questions please call me @ 467-3298

Date Signed H W Bacon

REPLY

—No 9 FOLD

—No 10 FOLD

Date Signed

WilsonJones
GRAYLINE FORM 44-902 3-PART
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RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants
1400 140th Avenue N.E.
Bellevue, Washington 98005
(206) 746-8020

COPY FOR YOUR INFORMATION

MONTGOMERY, PURDUE BLANKENSHIP & AUSTIN
58th Floor, Columbia Center
701 Fifth Avenue
Seattle, WA 98104

W-4740

12 February 1986

COPY SENT TO
CLIENT ✓
DATE 2/19/86
BY

Mr. (b) (6)
c/o Montgomery Purdue Blankenship & Austin
5800 Columbia Center
701 Fifth Avenue
Seattle, Washington 98104

Attention: Mr. Jerry Spoonamore

Subject: Evaluation of Railroad Embankment Repairs
(b) (6) Residence Slide Area
Bellevue, Washington

Gentlemen:

8" never full in 100 year storm.

At the request of Mr. (b) (6), we have looked at the railroad embankment repairs recently completed by the Burlington Northern Railroad adjacent to the subject homesite. Work performed by the railroad company crews appears to include:

- Timber crib wall installation;
- Reconstruction of the west side of the embankment;
- Installation of ballast and re-leveling of tracks;
- Storm drain intake repairs
- Drainage ditch re-shaping east of the railroad grade.

Is 18" pipe cracked

The railroad crews have installed a timber crib on the side of the embankment above the (b) (6) residence. The base of the crib has been set from approximately 2 to 8 feet above the elevation of the driveway by the (b) (6) home. The crib had been installed utilizing treated timber railroad ties. The majority of these ties appear to be used rather than new. The face of the crib has not been installed in a straight line; rather it meanders relative to the centerline of the tracks and the distance from the (b) (6) driveway.

believe that the factor of safety against sliding is now lower than before. This is born out by the report of postcrib wall installation movement of the rockery. Thus, the railroad should understand that further movement of the embankment will probably occur and there would be loss of support to the roadbed.

The storm drain intake has been modified by the railroad crew during the past week. They have removed a concrete block which had become wedged in the pipe which leads under the fill. This block however, is still sitting at the bottom of the manhole. The manhole intake structure itself is supported by several concrete blocks and it appears that water entering the manhole is able to enter the ground around the storm drain pipe. It does not appear that the bottom of the manhole has been sealed nor has the manhole been grouted to the storm drain pipe; although these are normal storm drain installation procedures. As a result, the collected water is able to bypass the storm drain and saturate the basal portion of the railroad fill.

The railroad crew has installed a timber crib around the storm drain intake, apparently in order to minimize the risk of debris entering the system. Spaces between the crib work appear to be on the order of 6 to 8 inches in vertical height. In addition, the opening into the storm drain is an uncovered manhole ring with no grating or barrier to mud or debris. Soil washed into the area from elsewhere, may enter the storm drain and reduce the capacity of the system. Most likely, plugging will develop at the intake or at one of the elbows in line. However, plugging may also take place betwen manholes. Should this later condition develop, it would be difficult or virtually impossible to reopen the system.

Immediately south of the storm drain intake the railroad crews had placed soil onto the east side of the fill and onto the hillside which rises toward Interstate 405 during portions of the reconstruction process. At the time of our inspection, we observed that only part of this soil had been removed. The railroad crews have however, excavated a drainage ditch along the toe of the embankment, through loose soil, that appears to consist primarily of sandy silts and silts with variable

Based upon our observations of the soil after the initial ground failure, it is our opinion that the base of the timber crib has been set, in all locations, above a failure plane which developed during sliding of the embankment. It needs to be understood that this slide occurred as a rotational failure in conjunction with the surficial erosion of the face of the embankment. Thus, the wall does not improve the stability of the embankment and further movement of the fill and wall will probably occur.

The timber crib has been backfilled utilizing a combination of granular fill and the tan and gray silts present in the problem area. The cells within the fill when examined from the exterior, can be seen to contain a variety of soils and it does not appear that an adequate drainage course has been installed through the problem area. During installation of the timber crib and backfilling, a portion of the rockery adjacent to the carport was observed to move laterally toward the carport several inches. We do not know if movement is continuing or if it has at least momentarily ceased. For this reason we have recommended that a surveyor check the position of the wall and rockery, relative to a fixed point or line.

Backfill above the crest of the timber crib consists of a variety of soils including both gravels and silts. Also within the fill mass there are variable quantities of organic debris. It is our understanding that the bulk of this embankment was not mechanically compacted. We have measured the inclination of the face of the fill and have determined that it rises at angles that range from 32 to more than 40 degrees above the horizontal. The face of the slope is loose, irregular and presently is raveling and dropping material onto the (b) (6) driveway. It has not been compacted nor protected from surficial erosion. Because of its excessive steepness, we believe that it will probably be subject to surficial slumping, gullying and erosion until the bank has been flattened appreciably. We estimate that compacted fill slope inclinations of 26 to 33 degrees would be more appropriate. The re-constructed embankment appears to now have a greater quanity of the soil near the upper portion of the fill than is present elsewhere in the vicinity and we understand more than what had been present prior to sliding. We therefore

quantities of organic debris. The bank at the edge of the drainage ditch appears to rise approximately 4 feet to 5 feet and is near vertical; with the ground above the crest of the cut continuing to rise to the east. This soil appears to be in a precarious position and will probably slump or erode into the drainage swale, damming the water to the south. Typically when this happens, the impounded water rises in level until the "dam" is overtopped. Subsequently, such a temporary embankment is rapidly eroded and the resulting mud will be washed into the storm drain. If, however, the "dam" is not eroded out, the impounded water will rise against the side of the marginally stable embankment further reducing its stability. This may result in failure of the embankment and movement of soil into the (b) (6) yard and garden area. It would also endanger trains and other rail traffic in the area.

In summary, the railroad has installed what appears to be an "emergency" patch on a relatively serious embankment failure. However, in its present configuration, the retaining structure (a timber crib wall) appears to be marginally stable at best and may subject the residence to considerable danger. Because of its position, this retaining structure has precluded Mr. (b) (6) from restoring his driveway, garden and carport to the pre-failure condition. In addition, the storm drain system has not been repaired in a manner similiar to normal storm drain intakes. Instead, water is able to bypass around the storm drain and saturate the basal portion of the fill. We have recommended to Mr. (b) (6) that he have a surveyor monitor the position of his rockery and the railroad's timber crib wall. If during the surveys evidence of yielding or movement are observed we recommend that you and the railroad be notified immediately because the hazards have become appreciable. Finally, the surface of the embankment above the crib wall is in a steep and potentially unstable position. The loose soil will wash and slide downward onto the (b) (6) property. We feel that this potential hazard should be corrected before Mr. (b) (6) is subject to additional inconvenience or danger.

We appreciate having the opportunity to provide this information. If you have any question, please do not hesitate to call.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Tom Bekey, Vice-President

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COPY FOR YOUR INFORMATION

MONTGOMERY, PURDUE, BLANKINSHIP & AUSTIN
58th Floor, Columbia Center
701 Fifth Avenue
Seattle, WA 98104

7 February 1986

W-4740

Mr. (b) (6)
c/o Montgomery Purdue Blankenship & Austin
5800 Columbia Center
701 Fifth Avenue
Seattle, Washington 98104

Attention: Mr. Jerry Spoonamore

Subject: Railroad Embankment Repair Observations
Adjacent to (b) (6) Residence
Pleasure Point Area
Bellevue, Washington

Gentlemen:

In accordance with your request, on Wednesday, February 5, 1986, we looked at railroad embankment repair operations taking place adjacent to your residence. At the time of our visit, we observed that personnel from the Burlington Northern Railroad were erecting a timber bin wall on the west side of the railroad embankment. The south end of this bin wall is located a short distance south of your carport and the work is proceeding in a northward direction. The wall is being constructed utilizing treated timber railroad ties and the cells of the wall appear to be backfilled primarily with angular rock fragments; quarry spalls. The base of the bin wall has been set at approximately the same elevation as the top of the rockery along side your carport. The face of the new construction appears to be located about 5 to 6 feet east of the face of the rockery.

We spoke briefly with the individual from the Burlington Northern crew who appeared to be in charge of the repair work. He indicated to us that as the retaining structure was extended northward, the base of the installation would be stepped downward so that it would rest upon what appeared to the crew to be adequate soil. We did not see any specific design drawings and during the period that we were at the site no work was performed in the area of the bin wall. The ground onto which the bin wall is being placed appears to consist of railroad embankment fill, which includes a mixture of medium stiff to very stiff, tan and gray blocks of silt in a silt, sand and gravel matrix. Based upon the configuration of the railroad embankment adjacent to the tracks and the fact that the rockery at the toe of the slope has been displaced, it is our opinion that the bin wall is being erected atop soil which has been subject to sliding. Therefore, it is probable that the reconstructed embankment supported by a bin wall will have lower than desirable factor of safety against future movement. It is very possible that this construction will reinitiate sliding onto our property.

At the time of our inspection, the intake to the storm drain located immediately east of the railroad track had been cleaned and water was flowing into the system through the grate at the ground surface. However, inspection of the storm drain intake area reveals that the uppermost segment of the concrete manhole has been displaced and water is entering the storm drain through the side of the installation. It also appears that debris, including soil and wood, are still present within the storm drain system at the approximate elevation of the first joint in the pipe below ground level. The railroad personnel informed us that they intend to remove the upper portion of the storm drain intake in order to further clean out the intake line and allow re-setting of the uppermost joint in the line. It is our understanding however, that there are no plans to inspect the rest of the system for integrity or to repair any damage if it does exist.

At the time of this site visit, the mud and debris which had washed onto the (b) (6) property and into the basement of the house had all been removed. The concrete driveway adjacent to the house is warped and broken. Within the carport the floor

is bowed upward and cracked. The rockery along the east margin of the yard area has apparently been displaced laterally and large quantities of water issue from the ground between some of the stones. The storage area of the carport appears to have been displaced both horizontally and vertically. The rockery alongside the carport is now either within a few inches of the building or resting directly against the structure. South of the carport at the toe of the railroad embankment, the vegetable garden area has been pushed upward by movement of the embankment. A masonry screen or wall which had defined the south margin of the garden area was knocked over by ground movement and the rubble has been removed from the property. Within the house, water continues to seep across the basement floor and appears to be rising upward through cracks in the floor slab. On the north side of the house the concrete walkway and adjacent masonry wall have shifted resulting in the development of cracks in the wall and a gap between the walkway and the building.

Based upon our observations, it is our professional opinion that the factor of safety against further movement of the railroad embankment is less than desirable. This is because the timber crib retention structure that the railroad crew is installing is situated above a slide plane in silty soils. Because of the limited horizontal distance that is being left between the timber crib wall and the rockery, we believe that it will be difficult or impossible to repair the bank protection system on the (b) (6) property or his carport. We understand that the railroad needs to complete at least temporary repairs to the road bed so that deliveries can be made north of the washout. It will likely be necessary however, to remove the railroad's newly erected timber crib wall and the underlying soil which has been displaced by sliding, in order to permanently stabilize the embankment. It appears more likely than not, that if the soil beneath the timber crib moves support for the tracks would be lost and access by the railroad through the area would be interrupted, again.

At the residence, it appears that mud and debris from the failure, have entered the foundation drainage system around the house. As a result, the footing drain apparently is no longer functioning and water is now entering the basement of the home. The proper procedure for correcting this situation would involve excavating downward around the exterior of the house to the elevation of the foundation drain, cleaning out of the line and re-installing the system. We recognize that it might be possible to restore the foundation drain to operation by flushing the lines from the downstream end. Unfortunately, it has been our experience that, this procedure may not be fully successful. A second approach which has been used with varying amounts of success for the management of seepage in a basement requires the excavation through the floor slab of a sump, coupled with the installation of a sump pump.

In summary, the Burlington Northern Railroad is attempting to effect repairs to the roadbed through the erection of a timber crib on the west side of the embankment. In order to permanently restore the (b) (6) property to its pre-slide and washout condition, it will likely be necessary to remove this installation, disrupting railroad service or it may be necessary to employ relatively heroic measures such as the installation of a slurry wall prior to modification of the rockery or repairs to the carport. It appears likely that the railroad could avoid unnecessary expenses of construction, dismantling and re-construction of the embankment, by performing a complete repair of the failed area instead of what appears to be a piecemeal operation. Additionally, we believe that clean out and repairs to the storm drain system over and above those contemplated by the railroad are still necessary. Also, a seepage management program will need to be instituted for the residence itself since the foundation drainage system appears to no longer be functioning.

We appreciate having the opportunity to provide this information. If you have any questions, please do not hesitate to call.

Respctfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Tom Bekey, Vice President

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COPY FOR YOUR INFORMATION

MONTGOMERY, PURDUE, BLANKENSHIP & AUSTI
58th Floor, Columbia Center
701 Fifth Avenue
Seattle, WA 98104

22 January 1986

W-4740

Mr. (b) (6)
c/o Montgomery Purdue Blankenship & Austin
5800 Columbia Center
701 Fifth Avenue
Seattle, Washington 98104

Attention: Mr. John Blankenship

Subject: Preliminary Assessment of Slide Damage
(b) (6) Residence
Pleasure Point Vicinity
Bellevue, Washington

Gentlemen:

In accordance with your request, we have visually examined the slide which occurred at the (b) (6) ' home on Hazelwood Lane off of Lake Washington Boulevard Southeast in Bellevue, Washington. Sliding apparently occurred on 18 January during a "100-year" storm.

As a result of ground movements involving the railroad grade immediately east of the (b) (6) property, the basement level garage of the residence has been filled with mud and debris, the carport has been dislodged from its foundations, several masonry walls and screens have been damaged and one has been destroyed, the rockery alongside the margin of the yard has been displaced with a portion being demolished and a layer of mud and debris have been deposited in the driveway. The railroad embankment east of the residence has been partially washed-out,

leaving ties and tracks unsupported in one area. To the north and south of the major failure the embankment which supports the tracks has settled and shifted on the order of 1 foot.

Immediately east of the tracks the railroad embankment slopes downward to a drainage swale some 10 to perhaps 20 feet below track grade. From the base of the swale the ground rises toward Interstate 405 and the pedestrian path alongside the freeway. At least two culverts discharge from the freeway right-of-way toward this swale area.

Near the lowest point of the depression on the east side of the tracks there is a storm drain intake, apparently constructed from manhole rings capped by a grate of some type. This intake apparently is plugged and surface runoff is flowing into the ground alongside the intake structure.

We have been informed that immediately prior to the failure, runoff water had collected between the freeway right-of-way and the railroad embankment to a depth on the order of 20 feet. According to photographs taken by Mr. (b) (6), water levels had risen almost to track elevation. Reportedly, at that time, water was flowing through and over the embankment, through the rockery, and appeared to have sufficient force to have elevated or bulged upward the concrete driveway alongside the residence. At about this time, according to Mr. (b) (6), a loud concussion was heard and water was seen to be escaping from a manhole located immediately north of his entrance gate on the east side of Hazelwood Lane. At that time also, very large quantities of water were observed discharging with considerable force from the storm drain outlet at the edge of Lake Washington and at about this time the side of the railroad grade failed with mud and debris flowing into the basement- level garage. Shortly after this occurred, water levels on the east side of the railroad tracks were observed to drop relatively rapidly until standing water was no longer present alongside the embankment.

Mr. (b) (6), in order to protect his possessions, removed the carpeting from the lower floor, placed the accessible furniture in the basement onto blocks and

removed most of the water from the floor. He also shoveled up whatever mud had entered the house from the garage so that the interior garage door could be closed. He also indicated that he is no longer staying in the house, until he has some assurance of the structure's safety.

At the time of our inspection on Monday, 20 January 1986, we observed water flowing into the ground alongside the storm drain intake system east of the railroad tracks. It appears that more water is flowing into the system than is discharging from the outlet pipe by Lake Washington. We also noted that large clods of blue-gray silt with gravel, on the order of 6 to 8 inches across, were lying on the lake front immediately adjacent to the storm drain discharge. We also noted that water is still flowing across the basement floor from east to west. In addition, the ground in front of the rockery at the toe of the embankment has been disturbed, pushed-up, and saturated. Finally, the driveway and automobile turn-around, where visible, adjacent to the mud and debris is not level. Instead, the concrete slabs have apparently shifted vertically relative to one another. Mud and debris stand several feet deep in the driveway area, to a lesser depth in the carport and has nearly filled the basement garage. According to Mr. (b) (6), trees planted on the side of the railroad embankment have been shifted laterally both north and south of the main failure area.

In order to protect the house from loads being imposed by the mud in the garage-basement, we suggest that the bulk of the debris be removed and the interior of the house cleaned up. The dirt must also be cleaned up around the exterior of the residence so that the building is not damaged by unbalanced earth pressures or water. Restoration of the yard, railroad embankment, and storm drain system, should, however, be preceded by an appropriate geotechnical evaluation.

Failure of the embankment was apparently caused by nearly 20 feet of water ponding behind the fill. Since the embankment was not designed to act as a dam, failure ensued. We also believe, based upon our visual inspection that the railroad embankment has now become saturated, coupled with significant movement and that this saturation has reduced the stability of the fill; most likely on a

permanent basis. We, therefore, recommend as an initial step, that one or more test borings be drilled through the railroad embankment in order to measure the in-situ strength of the soils and to locate the elevation of the ground water or piezometric table. If the peizometric surface is elevated, prior to additional work, it may be necessary to install a system of horizontal drains through the railroad embankment to collect this perched water and allow it to escape from the soil. A slope stability analysis of the embankment should also be performed in order to establish criteria for safe reconstruction of the railroad grade. In order to accomplish such a stability analysis it would be necessary to have an accurate topographic map of the effected areas. In addition, it will be necessary to have the storm drain system inspected and because we believe that the system has been ruptured, the line should be repaired. Included in this repair work, it will be necessary to reopen the storm drain intake and to backfill around the sides of the line wherever voids have been created by the flowing water.

Based upon the results of the geotechnical exploration and stability analysis, recommendations for reconstruction of the railroad fill may be developed. In order to restore the (b) (6) yard to its pre-failure configuration, it may be necessary to install a structural wall rather than a rockery along the margin of the railroad embankment. This is because, since the fill has moved, it may no longer be as stable as it had been prior to movement. Thus, there may not be a sufficient factor of safety against future movement if only a rockery is used for bank protection. Because there will remain a potential for the intake on this storm drain system to become plugged at a future date, we believe that it would be prudent to connect any storm drain lines discharging into the area between I-405 and the railroad embankment directly into the storm drain system.

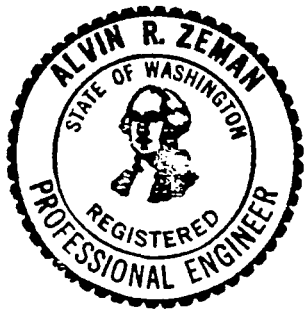
We appreciate having the opportunity to provide this information. If you have any questions, please do not hesitate to call.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Tom Bekey, Vice-President

Alvin R. Zeman, P.E.



MSP
DRO
DRS

KENNYDALE, WA.

SLIP OUT MP 74

1/24/86

	AZIMUTH	VER ∠.	DIS.	PRISM	REMARKS
1	0	0	0		I.H. FS.1 & TRK
2	70°-10'-00"	284°-51'-40"	100.04	7.95	F/C HIGHWAY CULVERTS 18" & 8" CMPs
3	10°-55'-50"	265°-29'-00"	142.52	5.35	Top M.H.
4	0°-59'-00"	270°-31'-00"	137.10	5.35	T/R
5	347°-29'-30"	261°-40'-46"	137.77	5.35	Top M.H. (-7.3 TO F/C)
6	345°-04'-15"	259°-24'-00"	124.77	5.35	Top SLOPE ROCK
7	175°-13'-15"	268°-10'-00"	270.76	5.35	F/C CULVERT 24"
8	183°-32'-30"	267°-47'-00"	271.27	5.35	F/C CULVERT 24"
9	179°-56'-30"	269°-49'-00"	982.39	5.35	Top T.E & TRK.
10	178°-40'-30"	269°-34'-00"	448.31	5.35	DITCH PROFILE
11	178°-18'-00"	269°-30'-50"	371.71	5.35	" "

	Azimuth	Ver ∠	Dis	Prism	Remarks
12	176°-29'-00"	269°-01'-00"	309.58	5.35	Ditch Profile
13	175°-02'-00"	268°-14'-00"	270.70	5.35	" "
14	174°-13'-00"	267°-36'-15"	204.82	5.35	" "
15	171°-42'-00"	266°-53'-20"	128.59	5.35	" "
16	171°-18'-40"	267°-40'-00"	93.20	5.35	" "
17	155°-29'-00"	262°-49'-10"	48.94	5.35	" "
18	74°-44'-15"	252°-53'-00"	14.68	5.35	" "
19	17°-29'-00"	262°-47'-30"	65.96	5.35	" "
20	14°-27'-30"	263°-55'-30"	99.68	5.35	" "
21	11°-01'-00"	264°-34'-30"	137.84	8.35	Sink Hole near M.H.
22	06°-08'-30"	268°-13'-00"	180.27	8.35	Ditch Profile
23	03°-59'-00"	269°-44'-00"	240.10	8.35	" "

	Azimuth	Ver. ∠	Dis	Prism	Remarks
24	03°-01'-00"	270°-13'-00"	371.58	8.35	Ditch Profile
25	01°-17'-30"	270°-26'-00"	460.48	8.35	" "
26	0°-19'-45"	270°-44'-15"	459.26	8.35	T/R
27	0°-00'-00"	271°-02'-00"	237.01	8.35	Top T.E & Trk
28	0°-00'-00"	269°-31'-30"	88.31	8.35	& Trk - Ground
29	354°-17'-30"	266°-05'-30"	85.63	8.35	Ground -
30	341°-29'-45"	261°-17'-30"	95.03	8.35	Ground -

M.S.P.
D.R.O.

LITE RAIN

1/27/86

4

KENNYDALE, WA

SLIP OUT MP 7.21

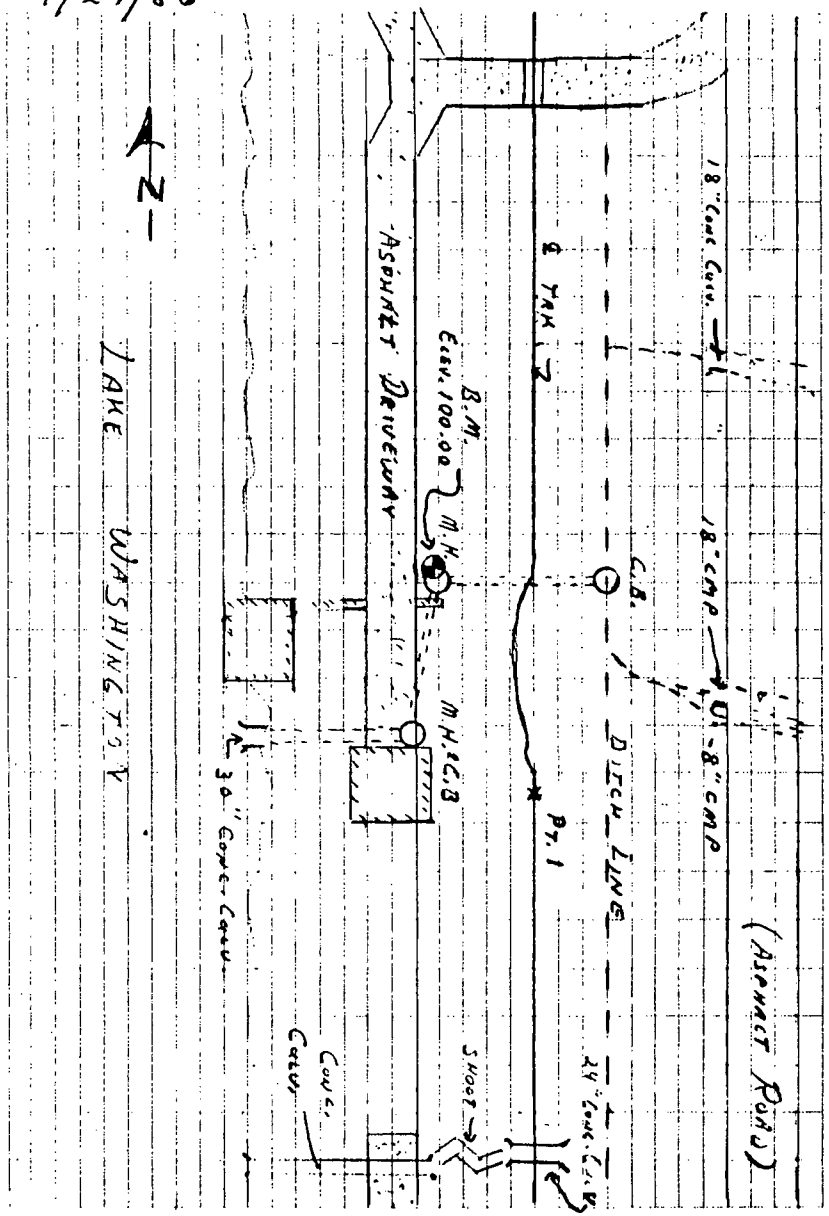
PT. 1 @ STA. 887+77 11"

FROM ASSUMED CULVERT STATION 897+59 50

N

W E

S



	Azimuth	Ver. ∠	Dis.	Prism	Remarks
1	0 ° ' "	0	0		I. H. = 5.1 @ Tr.
5	342°-33'-00"	261°-43'-45"	138.03	5.35	
31	342°-59'-00"	259°-32'-30"	126.53	5.35	Brick Gate Post
32	345°-47'-30"	260°-15'-00"	125.25	7.35	Fence & Rock Buttress
33	339°-05'-00"	260°-38'-30"	129.48	7.35	Brick Gate Post
34	335°-41'-00"	260°-44'-00"	130.55	7.35	Bldg. Cor.
35	326°-39'-00"	263°-47'-40"	100.30	6.35	Bldg. Cor.
36	321°-01'-30"	254°-01'-30"	101.77	6.35	Bldg. Cor. & Retaining Wall
37	310°-22'-30"	254°-03'-00"	77.93	8.35	Retaining Wall Cor.
38	310°-37'-00"	256°-27'-00"	79.29	8.35	(30" Conc Culv. Outlet -9.0 to F/L)
39	326°-12'-15"	251°-33'-00"	65.50	8.35	Top M.H. -8.2 to Bottom M.H. -6.7 to Outlet Pipe ≈5.7 to Inlet Pipe

	Azimuth	Ver. ∠	Dis	Prism	Remarks
40	324°-44'-15"	249°-51'-30"	59.08	8.35	Garage Cor & Rock Wall
41	311°-39'-00"	253°-10'-00"	70.78	8.35	Garage Cor.
42	287°-19'-00"	248°-09'-30"	58.25	8.35	Garage Cor.
43	295°-44'-30"	238°-48'-00"	43.85	6.35	Garage Cor & Rock Wall
44	190°-16'-30"	272°-21'-00"	14.39	5.35	T/R Begin Slip Out
45	194°-17'-00"	269°-20'-30"	14.89	5.35	Ground
46	230°-22'-15"	246°-07'-30"	23.48	5.35	Ground
47	247°-06'-45"	240°-45'-30"	41.28	5.35	Top Rock Wall
48	249°-54'-15"	237°-32'-15"	45.28	5.35	Bottom Rock Wall
49	255°-11'-45"	246°-33'-00"	62.89	5.35	Top Slope
50	256°-08'-00"	246°-49'-00"	74.68	8.35	Toe Slope Edge Water

	Azimuth	Ver. ∠	Dis	Prism	Remarks
51	358°-55'-00"	270°-33'-30"	132.96	5.35	T/R End Slip Out
52	358°-12'-45"	270°-14'-00"	133.01	5.35	Edge Tie
53	351°-35'-00"	265°-22'-15"	134.07	5.35	Ground
54	348°-42'-00"	262°-55'-45"	134.34	5.35	Top Rock Wall
55	347°-24'-30"	261°-38'-45"	134.86	8.35	Bottom Rock Wall
56	342°-03'-45"	261°-29'-00"	137.70	8-35	& Driveway
57	0°-23'-30"	270°-23'-00"	381.61	5.35	T/R Opposite 18" Conc. Culv. F/L 10.0' Above T/R 55' East of ℄ Trk.

KENNYDALE, WA.

SLIP OUT MP 7.21 ~ REDUCED NOTES

	STA.	DIST. OUT	ELEV.	
1	887+77 12	0	120.19	℄ TRK.
2	887+44 31	90.95 E.	143.00	F/L HIGHWAY CULVERT 18" & 8" CMPs
3	86+37 62	26.94 E.	108.71	TOP C.B.
4	86+40 04	2.35 E.	121.17	T/R
5	86+44 03	29.52 W	100.00	TOP M.H. (-7.3 TO F/L) B.M. ELEV. = 100.00
6	86+58 61	31.60 W	96.99	TOP ROCK
7	90+46 80	22.55 E	111.28	F/L CULVERT 24"
8	90+47.66	16.75 W	109.45	F/L CULVERT 24"
9	97+59 50	1.00 E	116.81	TOP TIE ℄ TRK. (ASSUMED CULVERT STATION)
10	92+25 30	10.37 E	116.55	DITCH PROFILE
11	91+48 65	11.03 E	116.78	" "

	STA.	DIST. OUT:	ELEV.	REMARKS
12	890+86 02	18.99 E.	114.63	DITCH PROFILE
13	90+46 67	23.43 E.	111.59	" "
14	89+80 21	20.62 E.	111.38	" "
15	89+04 17	18.54 E.	112.96	" "
16	88+69 17	14.07 E.	116.14	" "
17	88+21 29	20.15 E.	113.82	" "
18	87+73 42	13.54 E.	115.62	" "
19	87+14 70	19.66 E.	111.66	" "
20	86+81 13	24.75 E.	109.39	" "
21	86+42 42	26.22 E.	103.91	SINK HOLE WEAR M. H.
22	85+97 93	19.28 E.	111.33	DITCH PROFILE

	STA.	Dist. Out	Elev.	Remarks
23	885+37 60	16.68 E.	115.82	Ditch Profile
24	84+06 05	19.55 E.	118.35	" "
25	83+16 77	10.38 E.	120.42	" "
26	83+17 90	2.64 E.	122.85	T/R
27	85+40 14	0	121.21	Top Tie & Trk.
28	86+88 81	0	116.21	Ground & Trk
29	86+92 10	8.50 W.	111.10	Ground
30	86+88 04	29.81 W.	102.55	Ground
31	86+58 14	36.41 W.	96.97	Brick Gate Post
32	86+57 45	30.30 W.	96.73	Brick Wall & Rock Wall Cor.
33	86+57 78	45.61 W.	96.88	Brick Gate Post

	STA.	DIST. OUT	ELEV.	REMARKS
34	886+59.70	53.06 W.	96.92	BLDG. COR.
35	86+96.67	52.95 W.	90.93	BLDG. COR.
36	87+01.05	61.54 W.	90.93	BLDG. COR. & RETAINING WALL
37	87+28.58	57.08 W	95.53	RETAINING WALL COR.
38	87+26.93	58.51 W.	98.36	WATER EDGE (30" CONC. OUTLET PIPE - 9.0 TO F/L)
39	87+25.48	34.56 W.	96.21	TOP M.H. & C.B - 8.2 TO BOTTOM M.H. & C.B - 6.7 TO OUTLET F/L - 5.7 TO INLET F/L
40	87+31.83	32.02 W.	96.59	COR. GARAGE & ROCK WALL
41	87+32.09	50.62 W.	96.44	COR. GARAGE
42	87+61.02	51.62 W.	95.27	COR. GARAGE
43	87+60.83	33.78 W.	96.22	COR. GARAGE & ROCK WALL

	STA.	Dist. Out	Elev.	Remarks
44	887+91 $^{26}_{-}$	2.56 W.	120.53	T/R Begin Slip Out
45	87+91 $^{54}_{-}$	3.67 W.	119.77	Top Slope
46	87+90 $^{81}_{-}$	16.54 W.	110.43	
47	87+91 $^{12}_{-}$	33.18 W.	99.77	Top Rock Wall
48	87+90 $^{24}_{-}$	35.88 W.	95.63	Bottom Rock Wall
49	87+91 $^{84}_{-}$	55.78 W.	94.91	Edge Bank
50	87+93 $^{57}_{-}$	66.65 W.	87.54	Water Edge Toe Slope
51	86+44 $^{19}_{-}$	2.51 W.	121.23	T/R End Slip Out
52	86+44 $^{17}_{-}$	4.15 W.	120.48	Top Slope
53	86+44 $^{23}_{-}$	19.66 W.	109.06	
54	86+46 $^{38}_{-}$	26.12 W.	103.40	Top Rock Wall

	STA.	D.St. Out	Elev.	Remarks
55	86+46.90	29.09 W.	97.34	Bottom Rock Wall
56	86+47.55	41.94 W.	96.54	℄ Driveway
57	83+95.52	2.61 E.	122.49	T/R Opposite Highway Culvert 18" Conc. + 10.0 to F/L 55.0' East of Track.

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COPY FOR YOUR INFORMATION

MONTGOMERY, PURDUE, BLANKINSHIP & AUSTIN
58th Floor, Columbia Center
701 Fifth Avenue
Seattle, WA 98104

7 February 1986

W-4740

Mr. (b) (6)
c/o Montgomery Purdue Blankenship & Austin
5800 Columbia Center
701 Fifth Avenue
Seattle, Washington 98104

Attention: Mr. Jerry Spoonamore

Subject: Railroad Embankment Repair Observations
Adjacent to (b) (6) Residence
Pleasure Point Area
Bellevue, Washington

Gentlemen:

In accordance with your request, on Wednesday, February 5, 1986, we looked at railroad embankment repair operations taking place adjacent to your residence. At the time of our visit, we observed that personnel from the Burlington Northern Railroad were erecting a timber bin wall on the west side of the railroad embankment. The south end of this bin wall is located a short distance south of your carport and the work is proceeding in a northward direction. The wall is being constructed utilizing treated timber railroad ties and the cells of the wall appear to be backfilled primarily with angular rock fragments; quarry spalls. The base of the bin wall has been set at approximately the same elevation as the top of the rockery along side your carport. The face of the new construction appears to be located about 5 to 6 feet east of the face of the rockery.

We spoke briefly with the individual from the Burlington Northern crew who appeared to be in charge of the repair work. He indicated to us that as the retaining structure was extended northward, the base of the installation would be stepped downward so that it would rest upon what appeared to the crew to be adequate soil. We did not see any specific design drawings and during the period that we were at the site no work was performed in the area of the bin wall. The ground onto which the bin wall is being placed appears to consist of railroad embankment fill, which includes a mixture of medium stiff to very stiff, tan and gray blocks of silt in a silt, sand and gravel matrix. Based upon the configuration of the railroad embankment adjacent to the tracks and the fact that the rockery at the toe of the slope has been displaced, it is our opinion that the bin wall is being erected atop soil which has been subject to sliding. Therefore, it is probable that the reconstructed embankment supported by a bin wall will have lower than desirable factor of safety against future movement. It is very possible that this construction will reinitiate sliding onto our property.

LOW SAFETY FACTOR

At the time of our inspection, the intake to the storm drain located immediately east of the railroad track had been cleaned and water was flowing into the system through the grate at the ground surface. However, inspection of the storm drain intake area reveals that the uppermost segment of the concrete manhole has been displaced and water is entering the storm drain through the side of the installation. It also appears that debris, including soil and wood, are still present within the storm drain system at the approximate elevation of the first joint in the pipe below ground level. The railroad personnel informed us that they intend to remove the upper portion of the storm drain intake in order to further clean out the intake line and allow re-setting of the uppermost joint in the line. It is our understanding however, that there are no plans to inspect the rest of the system for integrity or to repair any damage if it does exist.

INSPECT SYSTEM DOWN STREAM

At the time of this site visit, the mud and debris which had washed onto the (b) (6) property and into the basement of the house had all been removed. The concrete driveway adjacent to the house is warped and broken. Within the carport the floor

is bowed upward and cracked. The rockery along the east margin of the yard area has apparently been displaced laterally and large quantities of water issue from the ground between some of the stones. The storage area of the carport appears to have been displaced both horizontally and vertically. The rockery alongside the carport is now either within a few inches of the building or resting directly against the structure. South of the carport at the toe of the railroad embankment, the vegetable garden area has been pushed upward by movement of the embankment. A masonry screen or wall which had defined the south margin of the garden area was knocked over by ground movement and the rubble has been removed from the property. Within the house, water continues to seep across the basement floor and appears to be rising upward through cracks in the floor slab. On the north side of the house the concrete walkway and adjacent masonry wall have shifted resulting in the development of cracks in the wall and a gap between the walkway and the building.

Based upon our observations, it is our professional opinion that the factor of safety against further movement of the railroad embankment is less than desirable. This is because the timber crib retention structure that the railroad crew is installing is situated above a slide plane in silty soils. Because of the limited horizontal distance that is being left between the timber crib wall and the rockery, we believe that it will be difficult or impossible to repair the bank protection system on the (b) (6) property or his carport. We understand that the railroad needs to complete at least temporary repairs to the road bed so that deliveries can be made north of the washout. It will likely be necessary however, to remove the railroad's newly erected timber crib wall and the underlying soil which has been displaced by sliding, in order to permanently stabilize the embankment. It appears more likely than not, that if the soil beneath the timber crib moves support for the tracks would be lost and access by the railroad through the area would be interrupted, again.

NO WAY OF KNOWING FOR SURE

At the residence, it appears that mud and debris from the failure, have entered the foundation drainage system around the house. As a result, the footing drain apparently is no longer functioning and water is now entering the basement of the home. The proper procedure for correcting this situation would involve excavating downward around the exterior of the house to the elevation of the foundation drain, cleaning out of the line and re-installing the system. We recognize that it might be possible to restore the foundation drain to operation by flushing the lines from the downstream end. Unfortunately, it has been our experience that, this procedure may not be fully successful. A second approach which has been used with varying amounts of success for the management of seepage in a basement requires the excavation through the floor slab of a sump, coupled with the installation of a sump pump.

SUMP

In summary, the Burlington Northern Railroad is attempting to effect repairs to the roadbed through the erection of a timber crib on the west side of the embankment. In order to permanently restore the (b) (6) property to its pre-slide and washout condition, it will likely be necessary to remove this installation, disrupting railroad service or it may be necessary to employ relatively heroic measures such as the installation of a slurry wall prior to modification of the rockery or repairs to the carport. It appears likely that the railroad could avoid unnecessary expenses of construction, dismantling and re-construction of the embankment, by performing a complete repair of the failed area instead of what appears to be a piecemeal operation. Additionally, we believe that clean out and repairs to the storm drain system over and above those contemplated by the railroad are still necessary. Also, a seepage management program will need to be instituted for the residence itself since the foundation drainage system appears to no longer be functioning.

DISRUPT RR OPERATN

CHECK OUT ENTIRE DRAIN SYSTEM

We appreciate having the opportunity to provide this information. If you have any questions, please do not hesitate to call.

Respctfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Tom Bekey, Vice President

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COPY FOR YOUR INFORMATION

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58th Floor, Columbia Center
701 Fifth Avenue
Seattle, WA 98104

12 February 1986

W-4740

COPY SENT TO
CLIENT ✓
DATE 2/19/86
BY

(b) (6)
c/o Montgomery Purdue Blankenship & Austin
5800 Columbia Center
701 Fifth Avenue
Seattle, Washington 98104

Attention: Mr. Jerry Spoonamore

Subject: Evaluation of Railroad Embankment Repairs
(b) (6) Residence Slide Area
Bellevue, Washington

Gentlemen:

At the request of Mr. (b) (6) we have looked at the railroad embankment repairs recently completed by the Burlington Northern Railroad adjacent to the subject homesite. Work performed by the railroad company crews appears to include:

- Timber crib wall installation;
- Reconstruction of the west side of the embankment;
- Installation of ballast and re-leveling of tracks;
- Storm drain intake repairs
- Drainage ditch re-shaping east of the railroad grade.

The railroad crews have installed a timber crib on the side of the embankment above the (b) (6) residence. The base of the crib has been set from approximately 2 to 8 feet above the elevation of the driveway by the (b) (6) home. The crib had been installed utilizing treated timber railroad ties. The majority of these ties appear to be used rather than new. The face of the crib has not been installed in a straight line; rather it meanders relative to the centerline of the tracks and the distance from the (b) (6) driveway.

Based upon our observations of the soil after the initial ground failure, it is our opinion that the base of the timber crib has been set, in all locations, above a failure plane which developed during sliding of the embankment. It needs to be understood that this slide occurred as a rotational failure in conjunction with the surficial erosion of the face of the embankment. Thus, the wall does not improve the stability of the embankment and further movement of the fill and wall will probably occur.

The timber crib has been backfilled utilizing a combination of granular fill and the tan and gray silts present in the problem area. The cells within the fill when examined from the exterior, can be seen to contain a variety of soils and it does not appear that an adequate drainage course has been installed through the problem area. During installation of the timber crib and backfilling, a portion of the rockery adjacent to the carport was observed to move laterally toward the carport several inches. We do not know if movement is continuing or if it has at least momentarily ceased. For this reason we have recommended that a surveyor check the position of the wall and rockery, relative to a fixed point or line.

Backfill above the crest of the timber crib consists of a variety of soils including both gravels and silts. Also within the fill mass there are variable quantities of organic debris. It is our understanding that the bulk of this embankment was not mechanically compacted. We have measured the inclination of the face of the fill and have determined that it rises at angles that range from 32 to more than 40 degrees above the horizontal. The face of the slope is loose, irregular and presently is raveling and dropping material onto the (b) (6) driveway. It has not been compacted nor protected from surficial erosion. Because of its excessive steepness, we believe that it will probably be subject to surficial slumping, gullying and erosion until the bank has been flattened appreciably. We estimate that compacted fill slope inclinations of 26 to 33 degrees would be more appropriate. The re-constructed embankment appears to now have a greater quanity of the soil near the upper portion of the fill than is present elsewhere in the vicinity and we understand more than what had been present prior to sliding. We therefore

believe that the factor of safety against sliding is now lower than before. This is born out by the report of postcrib wall installation movement of the rockery. Thus, the railroad should understand that further movement of the embankment will probably occur and there would be loss of support to the roadbed.

The storm drain intake has been modified by the railroad crew during the past week. They have removed a concrete block which had become wedged in the pipe which leads under the fill. This block however, is still sitting at the bottom of the manhole. The manhole intake structure itself is supported by several concrete blocks and it appears that water entering the manhole is able to enter the ground around the storm drain pipe. It does not appear that the bottom of the manhole has been sealed nor has the manhole been grouted to the storm drain pipe; although these are normal storm drain installation procedures. As a result, the collected water is able to bypass the storm drain and saturate the basal portion of the railroad fill.

The railroad crew has installed a timber crib around the storm drain intake, apparently in order to minimize the risk of debris entering the system. Spaces between the crib work appear to be on the order of 6 to 8 inches in vertical height. In addition, the opening into the storm drain is an uncovered manhole ring with no grating or barrier to mud or debris. Soil washed into the area from elsewhere, may enter the storm drain and reduce the capacity of the system. Most likely, plugging will develop at the intake or at one of the elbows in line. However, plugging may also take place betwen manholes. Should this later condition develop, it would be difficult or virtually impossible to reopen the system.

Immediately south of the storm drain intake the railroad crews had placed soil onto the east side of the fill and onto the hillside which rises toward Interstate 405 during portions of the reconstruction process. At the time of our inspection, we observed that only part of this soil had been removed. The railroad crews have however, excavated a drainage ditch along the toe of the embankment, through loose soil, that appears to consist primarily of sandy silts and silts with variable

quantities of organic debris. The bank at the edge of the drainage ditch appears to rise approximately 4 feet to 5 feet and is near vertical; with the ground above the crest of the cut continuing to rise to the east. This soil appears to be in a precarious position and will probably slump or erode into the drainage swale, damming the water to the south. Typically when this happens, the impounded water rises in level until the "dam" is overtopped. Subsequently, such a temporary embankment is rapidly eroded and the resulting mud will be washed into the storm drain. If, however, the "dam" is not eroded out, the impounded water will rise against the side of the marginally stable embankment further reducing its stability. This may result in failure of the embankment and movement of soil into the (b) (6) yard and garden area. It would also endanger trains and other rail traffic in the area.

In summary, the railroad has installed what appears to be an "emergency" patch on a relatively serious embankment failure. However, in its present configuration, the retaining structure (a timber crib wall) appears to be marginally stable at best and may subject the residence to considerable danger. Because of its position, this retaining structure has precluded Mr. (b) (6) from restoring his driveway, garden and carport to the pre-failure condition. In addition, the storm drain system has not been repaired in a manner similiar to normal storm drain intakes. Instead, water is able to bypass around the storm drain and saturate the basal portion of the fill. We have recommended to Mr. (b) (6) that he have a surveyor monitor the position of his rockery and the railroad's timber crib wall. If during the surveys evidence of yielding or movement are observed we recommend that you and the railroad be notified immediately because the hazards have become appreciable. Finally, the surface of the embankment above the crib wall is in a steep and potentially unstable position. The loose soil will wash and slide downward onto the (b) (6) property. We feel that this potential hazard should be corrected before Mr. (b) (6) is subject to additional inconvenience or danger.

We appreciate having the opportunity to provide this information. If you have any question, please do not hesitate to call.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Tom Bekey, Vice-President

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COPY FOR YOUR INFORMATION

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58th Floor, Columbia Center
701 Fifth Avenue
Seattle, WA 98104

22 January 1986

W-4740

(b)
c/o Montgomery Purdue Blankenship & Austin
5800 Columbia Center
701 Fifth Avenue
Seattle, Washington 98104

Attention: Mr. John Blankenship

Subject: Preliminary Assessment of Slide Damage
(b) (6) Residence
Pleasure Point Vicinity
Bellevue, Washington

Gentlemen:

In accordance with your request, we have visually examined the slide which occurred at the (b) (6) home on Hazelwood Lane off of Lake Washington Boulevard Southeast in Bellevue, Washington. Sliding apparently occurred on 18 January during a "100-year" storm.

As a result of ground movements involving the railroad grade immediately east of the (b) (6) ' property, the basement level garage of the residence has been filled with mud and debris, the carport has been dislodged from its foundations, several masonry walls and screens have been damaged and one has been destroyed, the rockery alongside the margin of the yard has been displaced with a portion being demolished and a layer of mud and debris have been deposited in the driveway. The railroad embankment east of the residence has been partially washed-out,

leaving ties and tracks unsupported in one area. To the north and south of the major failure the embankment which supports the tracks has settled and shifted on the order of 1 foot.

Immediately east of the tracks the railroad embankment slopes downward to a drainage swale some 10 to perhaps 20 feet below track grade. From the base of the swale the ground rises toward Interstate 405 and the pedestrian path alongside the freeway. At least two culverts discharge from the freeway right-of-way toward this swale area.

Near the lowest point of the depression on the east side of the tracks there is a storm drain intake, apparently constructed from manhole rings capped by a grate of some type. This intake apparently is plugged and surface runoff is flowing into the ground alongside the intake structure.

We have been informed that immediately prior to the failure, runoff water had collected between the freeway right-of-way and the railroad embankment to a depth on the order of 20 feet. According to photographs taken by Mr. (b) (6) water levels had risen almost to track elevation. Reportedly, at that time, water was flowing through and over the embankment, through the rockery, and appeared to have sufficient force to have elevated or bulged upward the concrete driveway alongside the residence. At about this time, according to Mr. (b) (6), a loud concussion was heard and water was seen to be escaping from a manhole located immediately north of his entrance gate on the east side of Hazelwood Lane. At that time also, very large quantities of water were observed discharging with considerable force from the storm drain outlet at the edge of Lake Washington and at about this time the side of the railroad grade failed with mud and debris flowing into the basement- level garage. Shortly after this occurred, water levels on the east side of the railroad tracks were observed to drop relatively rapidly until standing water was no longer present alongside the embankment.

Mr. (b) (6), in order to protect his possessions, removed the carpeting from the lower floor, placed the accessible furniture in the basement onto blocks and

removed most of the water from the floor. He also shoveled up whatever mud had entered the house from the garage so that the interior garage door could be closed. He also indicated that he is no longer staying in the house, until he has some assurance of the structure's safety.

At the time of our inspection on Monday, 20 January 1986, we observed water flowing into the ground alongside the storm drain intake system east of the railroad tracks. It appears that more water is flowing into the system than is discharging from the outlet pipe by Lake Washington. We also noted that large clods of blue-gray silt with gravel, on the order of 6 to 8 inches across, were lying on the lake front immediately adjacent to the storm drain discharge. We also noted that water is still flowing across the basement floor from east to west. In addition, the ground in front of the rockery at the toe of the embankment has been disturbed, pushed-up, and saturated. Finally, the driveway and automobile turn-around, where visible, adjacent to the mud and debris is not level. Instead, the concrete slabs have apparently shifted vertically relative to one another. Mud and debris stand several feet deep in the driveway area, to a lesser depth in the carport and has nearly filled the basement garage. According to Mr. (b) (6) trees planted on the side of the railroad embankment have been shifted laterally both north and south of the main failure area.

In order to protect the house from loads being imposed by the mud in the garage-basement, we suggest that the bulk of the debris be removed and the interior of the house cleaned up. The dirt must also be cleaned up around the exterior of the residence so that the building is not damaged by unbalanced earth pressures or water. Restoration of the yard, railroad embankment, and storm drain system, should, however, be preceded by an appropriate geotechnical evaluation.

Failure of the embankment was apparently caused by nearly 20 feet of water ponding behind the fill. Since the embankment was not designed to act as a dam, failure ensued. We also believe, based upon our visual inspection that the railroad embankment has now become saturated, coupled with significant movement and that this saturation has reduced the stability of the fill; most likely on a

permanent basis. We, therefore, recommend as an initial step, that one or more test borings be drilled through the railroad embankment in order to measure the in-situ strength of the soils and to locate the elevation of the ground water or piezometric table. If the peizometric surface is elevated, prior to additional work, it may be necessary to install a system of horizontal drains through the railroad embankment to collect this perched water and allow it to escape from the soil. A slope stability analysis of the embankment should also be performed in order to establish criteria for safe reconstruction of the railroad grade. In order to accomplish such a stability analysis it would be necessary to have an accurate topographic map of the effected areas. In addition, it will be necessary to have the storm drain system inspected and because we believe that the system has been ruptured, the line should be repaired. Included in this repair work, it will be necessary to reopen the storm drain intake and to backfill around the sides of the line wherever voids have been created by the flowing water.

Based upon the results of the geotechnical exploration and stability analysis, recommendations for reconstruction of the railroad fill may be developed. In order to restore the (b) (6) yard to its pre-failure configuration, it may be necessary to install a structural wall rather than a rockery along the margin of the railroad embankment. This is because, since the fill has moved, it may no longer be as stable as it had been prior to movement. Thus, there may not be a sufficient factor of safety against future movement if only a rockery is used for bank protection. Because there will remain a potential for the intake on this storm drain system to become plugged at a future date, we believe that it would be prudent to connect any storm drain lines discharging into the area between I-405 and the railroad embankment directly into the storm drain system.

We appreciate having the opportunity to provide this information. If you have any questions, please do not hesitate to call.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Tom Bekey, Vice-President

Alvin R. Zeman, P.E.